

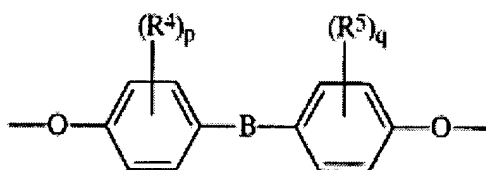
Claims:

1. A method of producing a copolycarbonate with improved color wherein the method comprises the steps of,

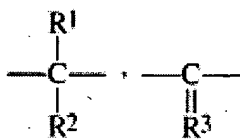
i. preparing a molten reaction mixture comprising a first dihydroxy aromatic compound comprising monomer residue (a), a second dihydroxy aromatic compound comprising monomer residue (b), and a carbonate source,

wherein monomer residue (a) is a quinone structure, or a structure capable of forming a quinone structure upon oxidation,

wherein monomer residue (b) is a quinone structure, or a structure capable of forming a quinone structure upon oxidation different from monomer residue (a) or is,



where B is



-O-, -CO-, -S-, -SO₂-, a C₆-C₂₀ aromatic radical, or a C₆-C₂₀ cycloaliphatic

radical; the groups R^1 and R^2 are independently a hydrogen atom, $C_1 - C_{20}$ alkyl radical, $C_4 - C_{20}$ cycloalkyl radical, or $C_6 - C_{20}$ aryl radical; or R^1 and R^2 together form a $C_4 - C_{20}$ cycloaliphatic ring which is optionally substituted by one or more $C_1 - C_{20}$ alkyl, $C_6 - C_{20}$ aryl, $C_5 - C_{21}$ aralkyl, $C_5 - C_{20}$ cycloalkyl groups or a combination thereof, R^3 is a divalent hydrocarbylene group, and R^4 and R^5 are independently a hydrogen atom, halogen atom, nitro group, cyano group, $C_1 - C_{20}$ alkyl radical, $C_4 - C_{20}$ cycloalkyl radical, or $C_6 - C_{20}$ aryl radical and p and q are both integers from 0 to 4,

ii. selecting a catalyst introduction strategy sufficient to result in a product copolycarbonate with improved color, wherein the catalyst introduction strategy is selected from the group consisting of,

1. introducing a polymerization catalyst to the molten reaction mixture after monomer residues (a), monomer residues (b), and carbonate source are melted and prior to substantial polymerization,
2. introducing a polymerization catalyst to the reaction mixture or monomer residues prior to melting with the proviso that residence time of the process from the start of melting until substantial polymerization has occurred is less than 4 hours, and
3. or a combination thereof,

wherein the polymerization catalyst is an inorganic catalyst, an organic catalyst, or both inorganic and organic catalyst which may be introduced separately or together,

iii. introducing the catalyst according to the selected catalyst introduction strategy,

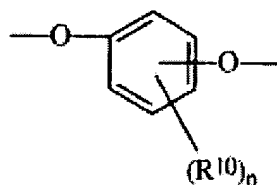
iv. introducing the reaction mixture to a series of process units, and

v. allowing the reaction mixture to polymerize in the series of process units thereby forming copolycarbonate, wherein the copolycarbonate has improved color as compared to a copolycarbonate formed in a melt process without the steps of selecting a catalyst introduction strategy and introducing catalyst according to the selected strategy.

2. The method of claim 1, wherein the polymerization catalyst comprises an organic and inorganic catalysts and is introduced to the reaction mixture after monomer residues (a), monomer residues (b), and carbonate source are melted and prior to substantial polymerization.

3. The method of claim 2, wherein the inorganic catalyst is NaOH and the organic catalyst is selected from the group consisting of TMAH, TBPA, and combinations thereof.

4. The method of claim 2, wherein monomer residue (a) has the structure,



where each R^{10} is independently at each occurrence a hydrogen atom, halogen atom, nitro group, cyano group, $C_1 - C_{20}$ alkyl, $C_4 - C_{20}$ cycloalkyl radical, $C_4 - C_{20}$ aryl radical, and n is an integer from 0 to 4.

5. The method of claim 4, wherein monomer residue (a) is catechol, resorcinol, hydroquinone, butyl hydroquinone, methyl hydroquinone or any combination thereof.

6. The method of claim 2, wherein monomer residue (b) is BPA.

7. The method of claim 2, wherein the carbonate source is diphenyl carbonate.
8. The method of claim 2, wherein the carbonate source is an activated carbonate.
9. The method of claim 8, wherein the activated carbonate is bismethylsalicylcarbonate.
10. The method of claim 2, wherein up to 50 mole% of the carbonate source is selected from the group consisting of dicarboxylic acids, dicarboxylic acid esters, dicarboxylic acid halide or any combination thereof.
11. The method of claim 2, wherein the inorganic and organic catalysts are introduced together.
12. The method of claim 11, wherein the inorganic and organic catalysts are introduced with monomer residue (a), monomer residue (b), the carbonate source or combinations thereof.
13. The method of claim 11, wherein the inorganic and organic catalysts are introduced to the reaction mixture in a separate feed to a monomer mix tank, a first process unit, or a feed line to a first process unit.
14. The method of claim 2, wherein the inorganic and organic catalysts are introduced to the molten reaction mixture at separate points.
15. The method of claim 14, wherein the organic catalyst is introduced to the molten reaction mixture prior to a first process unit and the inorganic catalyst is introduced to the molten reaction mixture after the introduction of the organic catalyst and prior to substantial polymerization of the reaction mixture.
16. The method of claim 14, wherein the organic catalyst is introduced with monomer residue (a), monomer residue (b), the carbonate source or combinations thereof and the inorganic catalyst

is introduced to the molten reaction mixture after the introduction of monomer (a).

17. The method of claim 14, wherein the inorganic catalyst is introduced to the molten reaction mixture in a feed line from a monomer mix tank to a first process unit, the first process unit, a feed line to a second process unit, the second process unit, a feed line to a third process unit, the third process unit, or combinations thereof.

18. The method of claim 2, wherein the method further comprises the step of introducing a dihydric phenol to the molten reaction mixture within the series of process units through late monomer addition.

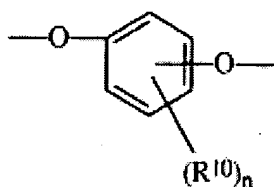
19. The method of claim 1, wherein the polymerization catalyst comprises organic and inorganic catalysts and is introduced to the reaction mixture or monomer residues prior to melting with the proviso that residence time of the process from the start of melting until substantial polymerization has occurred is less than 4 hours.

20. The method of claim 19, wherein the residence time of the process from the start of melting until substantial polymerization has occurred is 30 minutes or less.

21. The method of claim 20, wherein the residence time of the process from the start of melting until substantial polymerization has occurred is 15 minutes or less minutes.

22. The method of claim 19, wherein the inorganic catalyst is NaOH and the organic catalyst is selected from the group consisting of TMAH, TBPA, and combinations thereof.

23. The method of claim 19, wherein monomer residue (a) has the structure,



where each R^{10} is independently at each occurrence a hydrogen atom, halogen atom, nitro group, cyano group, $C_1 - C_{20}$ alkyl, $C_4 - C_{20}$ cycloalkyl radical, $C_4 - C_{20}$ aryl radical, and n is an integer from 0 to 4.

24. The method of claim 19, wherein monomer residue (a) is catechol, resorcinol, hydroquinone, butyl hydroquinone, methyl hydroquinone or any combination thereof.

25. The method of claim 19, wherein monomer residue (b) is BPA.

26. The method of claim 19, wherein the carbonate source is diphenyl carbonate.

27. The method of claim 19, wherein the carbonate source is an activated carbonate and is bismethylsalicylcarbonate.

28. The method of claim 19, wherein up to 50 mole% of the precursor of the carbonate source is derived from the group consisting of dicarboxylic acids, dicarboxylic acid esters, dicarboxylic acid halide or any combination thereof.

29. The method of claim 19, wherein the inorganic and organic catalysts are introduced together or separately.

30. The method of claim 50, wherein the inorganic and organic catalysts are introduced to a

monomer mix tank or a melter together with monomer residue (a), together with monomer residue (b), together with the carbonate source, in a separate feed or combinations thereof.

31. The method of claim 1, wherein the polymerization catalyst comprises organic and inorganic catalysts,

wherein the organic catalyst is introduced to the reaction mixture or monomer residues prior to melting with the proviso that residence time of the process from the start of melting until substantial polymerization has occurred is less than 4 hours, and

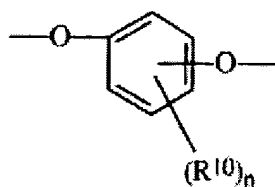
wherein the inorganic catalyst is introduced to the reaction mixture after monomer residues (a), monomer residues (b), and carbonate source are melted, and wherein the introduction occurs prior to substantial polymerization.

32. The method of claim 31, wherein the residence time of the process from the start of melting until substantial polymerization has occurred is 30 minutes or less.

33. The method of claim 32, wherein the residence time of the process from the start of melting until substantial polymerization has occurred is 15 minutes or less.

34. The method of claim 31, wherein the inorganic catalyst is NaOH and the organic catalyst is selected from the group consisting of TMAH, TBPA, and combinations thereof.

35. The method of claim 31, wherein monomer residue (a) has the structure,



where each R¹⁰ is independently at each occurrence a hydrogen atom, halogen atom, nitro

group, cyano group, $C_1 - C_{20}$ alkyl, $C_4 - C_{20}$ cycloalkyl radical, $C_4 - C_{20}$ aryl radical, and n is an integer from 0 to 4.

36. The method of claim 35, wherein monomer residue (a) is catechol, resorcinol, hydroquinone, butyl hydroquinone, methyl hydroquinone or any combination thereof.

37. The method of claim 31, wherein monomer residue (b) is BPA.

38. The method of claim 31, wherein the carbonate source is diphenyl carbonate.

39. The method of claim 31, wherein the carbonate source is an activated carbonate and is bismethylsalicylcarbonate.

40. The method of claim 31, wherein up to 50 mole% of the precursor of the carbonate source is derived from the group consisting of dicarboxylic acids, dicarboxylic acid esters, dicarboxylic acid halide or any combination thereof.

41. The method of claim 31, wherein the organic catalyst is introduced to a monomer mix tank or a melter together with monomer residue (a), together with monomer residue (b), together with the carbonate source, in a separate feed or combinations thereof, and

wherein the inorganic catalyst is introduced to the molten reaction mixture, within a monomer mix tank, a feed line from a monomer mix tank to a first process unit, the first process unit, a feed line to a second process unit, the second process unit, a feed line to a third process unit, the third process unit, or combinations thereof.

42. The method of claim 1, wherein the copolymer has a molecular weight M_w of at least 10,000 g/mole (Polystyrene standards) and the molecular weight M_w is subsequently increased to a value higher than 25,000 g/mole (Polystyrene standards) using a standard extrusion step.

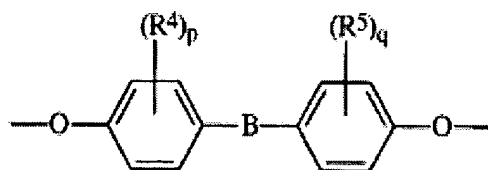
43. The method of claim 1, wherein the copolymer has a molecular weight Mw of at least 10,000 g/mole (Polystyrene standards) and the molecular weight Mw is subsequently increased to a value higher than 25,000 g/mole (Polystyrene standards) by further reaction of oligomers by means of solid state polymerization.

44. A molded article formed from copolycarbonate with improved color prepared by the method comprising the steps of,

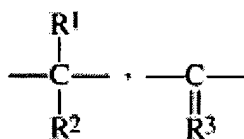
i. preparing a molten reaction mixture comprising a first dihydroxy aromatic compound comprising monomer residue (a), a second dihydroxy aromatic compound comprising monomer residue (b), and a carbonate source,

wherein monomer residue (a) is a quinone structure, or a structure capable of forming a quinone structure upon oxidation,

wherein monomer residue (b) is a quinone structure, or a structure capable of forming a quinone structure upon oxidation different from monomer residue (a) or is,



where B is



-O-, -CO-, -S-, -SO₂-, a C₆ - C₂₀ aromatic radical, or a C₆ - C₂₀ cycloaliphatic radical; the groups R¹ and R² are independently a hydrogen atom, C₁ - C₂₀ alkyl radical, C₄ - C₂₀ cycloalkyl radical, or C₄ - C₂₀ aryl radical; or R¹ and R² together form a C₄ - C₂₀ cycloaliphatic ring which is optionally substituted by one or more C₁ - C₂₀ alkyl, C₆ - C₂₀ aryl, C₅ - C₂₁ aralkyl, C₅ - C₂₀ cycloalkyl groups or a combination thereof, R³ is a divalent hydrocarbylene group, and R⁴ and R⁵ are independently a hydrogen atom, halogen atom, nitro group, cyano group, C₁ - C₂₀ alkyl radical, C₄ - C₂₀ cycloalkyl radical, or C₆ - C₂₀ aryl radical and p and q are both integers from 0 to 4,

ii. selecting a catalyst introduction strategy sufficient to result in a product copolycarbonate with improved color, wherein the catalyst introduction strategy is selected from the group consisting of,

1. introducing a polymerization catalyst to the molten reaction mixture after monomer residues (a), monomer residues (b), and carbonate source are melted and prior to substantial polymerization,
2. introducing a polymerization catalyst to the reaction mixture or monomer residues prior to melting with the proviso that residence time of the process from the start of melting until substantial polymerization has occurred is less than 4 hours, and
3. or a combination thereof,

wherein the polymerization catalyst is an inorganic catalyst, an organic catalyst, or both inorganic and organic catalyst which may be introduced separately or together,

iii. introducing the catalyst according to the selected catalyst introduction strategy,

iv. introducing the reaction mixture to a series of process units,

v. allowing the reaction mixture to polymerize in the series of process units thereby forming copolycarbonate, wherein the copolycarbonate has improved color as compared to a copolycarbonate formed in a melt process without the steps of selecting a catalyst introduction strategy and introducing catalyst according to the selected strategy, and

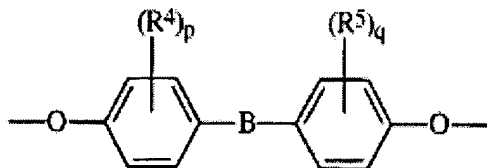
vi. forming a molded article from the copolycarbonate.

45. A method for making a molded article formed from copolycarbonate with improved color prepared by the method comprising the steps of,

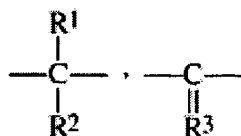
i. preparing a molten reaction mixture comprising a first dihydroxy aromatic compound comprising monomer residue (a), a second dihydroxy aromatic compound comprising monomer residue (b), and a carbonate source,

wherein monomer residue (a) is a quinone structure, or a structure capable of forming a quinone structure upon oxidation,

wherein monomer residue (b) is a quinone structure, or a structure capable of forming a quinone structure upon oxidation different from monomer residue (a) or is,



where B is



-O-, -CO-, -S-, -SO₂-, a C₆ - C₂₀ aromatic radical, or a C₆ - C₂₀ cycloaliphatic radical; the groups R¹ and R² are independently a hydrogen atom, C₁ - C₂₀ alkyl radical, C₄ - C₂₀ cycloalkyl radical, or C₄ - C₂₀ aryl radical; or R¹ and R² together form a C₄ - C₂₀ cycloaliphatic ring which is optionally substituted by one or more C₁ - C₂₀ alkyl, C₆ - C₂₀ aryl, C₅ - C₂₁ aralkyl, C₅ - C₂₀ cycloalkyl groups or a combination thereof, R³ is a divalent hydrocarbylene group, and R⁴ and R⁵ are independently a hydrogen atom, halogen atom, nitro group, cyano group, C₁ - C₂₀ alkyl radical, C₄ - C₂₀ cycloalkyl radical, or C₆ - C₂₀ aryl radical and p and q are both integers from 0 to 4,

ii. selecting a catalyst introduction strategy sufficient to result in a product copolycarbonate with improved color, wherein the catalyst introduction strategy is selected from the group consisting of,

1. introducing a polymerization catalyst to the molten reaction mixture after monomer residues (a), monomer residues (b), and carbonate source are melted and prior to substantial polymerization,

2. introducing a polymerization catalyst to the reaction mixture or monomer residues prior to melting with the proviso that residence time of the process from the start of melting until substantial polymerization has occurred is less than 4 hours, and

3. or a combination thereof,

wherein the polymerization catalyst is an inorganic catalyst, an organic catalyst, or both inorganic and organic catalyst which may be introduced separately or together,

iii. introducing the catalyst according to the selected catalyst introduction strategy,

iv. introducing the reaction mixture to a series of process units,

v. allowing the reaction mixture to polymerize in the series of process units thereby forming copolycarbonate, wherein the copolycarbonate has improved color as compared to a copolycarbonate formed in a melt process without the steps of selecting a catalyst introduction strategy and introducing catalyst according to the selected strategy, and

vi. forming a molded article from the copolycarbonate.